

800xA Simulator

Full-scale simulation for Ormen Lange



Nyhamna processing plant. Image courtesy of Shell.

System 800xA Simulators are playing a key role in the development and operation of Ormen Lange, one of Europe's largest and technologically most advanced natural gas projects.

The simulators were instrumental to production starting three weeks ahead of schedule in 2007, and are central to the continuous improvement and expansion of the field, including the development of the world's largest subsea compression project.

One of Europe's landmark natural gas projects

Ormen Lange is one of Europe's largest and technologically most advanced natural gas projects. Discovered in 1997, the field is located in the Norwegian Sea 120 kilometers off the coast of Norway. The reservoir lies some 3,000 meters below the seabed and contains recoverable gas reserves of some 400 billion standard cubic meters (scm).

The gas wells are located on the sea floor at depths of 800-1100 meters, and are the world's largest wellheads to date. The gas is transported from the reservoir through two multi-phase pipelines to an onshore processing plant at Nyhamna, Norway, where it is dried and compressed. Nyhamna processes some 20 billion scm of gas a year.

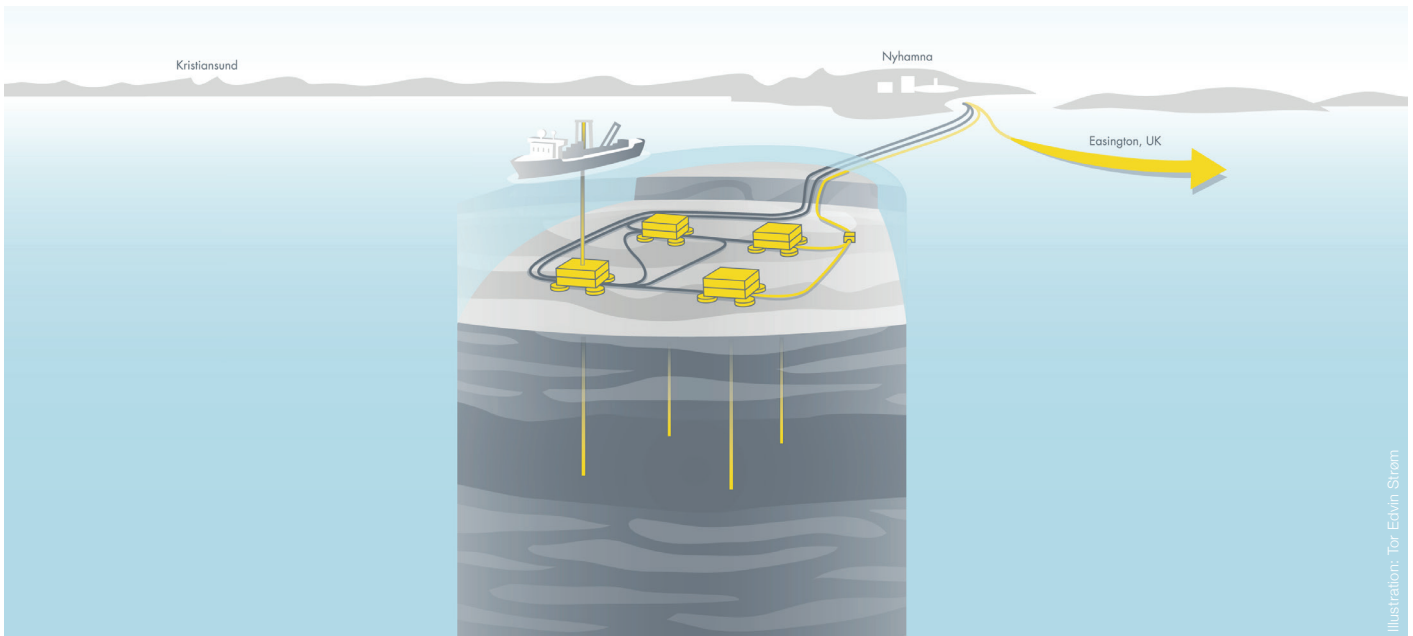


Illustration: Tor Edvin Strøm



Illustration of the Ormen Lange gas field. Courtesy of Shell. | Operators are trained, and new processes and subsystems are designed, engineered, corrected and tested in the 800xA Simulator before they are integrated into the main control system.

After processing, the gas is transported in the 1,200 km Langede pipeline to the Easington Gas Terminal on the east coast of England. Langede is the world's second longest subsea pipeline, just 22 km shorter than the recently opened Nord Stream gas pipeline in the Baltic Sea.

Ormen Lange delivers close to 20 percent of the UK's gas requirements and makes Norway the world's second largest exporter of natural gas. Production at the field started in September 2007. Statoil was responsible for the development of Ormen Lange, and Norske Shell is responsible for its operation.

Process control at Ormen Lange

ABB process control, safety and information management systems monitor and control the gas processing plant, the subsea installations and the flow of gas through the pipeline.

Based on ABB's System 800xA Extended Automation control platform, the solution is a huge and fully integrated system controlled by 67 AC 800M and AC 800M HI controllers from 28 operator workplaces and eight engineering stations. The process comprises some 15,000 I/Os. Included in the solution are applications for daily operation, maintenance, planning and reporting, as well as an OPC interface for third-party solutions for metering, valve monitoring, vibration monitoring, SAP and customer reporting.

Production at Ormen Lange began three weeks ahead of schedule, thanks largely to using the 800xA Simulator for process testing and operator training in parallel with construction.

From simulation to production

A key part of the ABB solution for Ormen Lange is the 800xA Simulator, which is an adapted version of the site's System 800xA automation system.

The simulator uses the process graphics and control logic of the site's process automation system to provide an identical operator environment and identical process control. Software-based controllers running on standard computer hardware are used instead of hardware controllers. The high fidelity process model, ASSET, uses OLGA (a multiphase flow simulator for engineering the flow of oil, water and gas in wells, pipelines and receiving facilities) to emulate the dynamic behavior of the wells and pipelines.

From the very beginning of the Ormen Lange project in 2004, emphasis was placed on training the operators and performing final testing of the control logic in parallel with construction of the onshore and offshore production facilities. Each of the many process sections was analyzed and tested in the simulator before construction was completed. One engineering and two operator simulators were used in parallel.

Production at Ormen Lange began in September 2007, three weeks ahead of schedule. According to Geir Fillip Håseth, operations engineer at Norske Shell, one of the main reasons for this valuable early start was the 800xA Simulator, which played a central role in the engineering, testing and startup phases of the project.

Evolution and integration

Ormen Lange is under constant development and expansion. New production templates, additional wells and a subsea compression project are among the investments either completed after 2007 or under development.

The 800xA Simulator is playing a key role in the growth and evolution of Ormen Lange by enabling new processes and subsystems to be designed, engineered, corrected and tested before they are integrated into the main control system.

In 2008 the power distribution system for the Nyhamna processing plant was integrated with the simulator to provide training for process and electrical system operators. Two new production templates – C and D – each initially comprising four wells, are scheduled to start production in 2012 and 2013 respectively. Both templates have been integrated with the simulator for design, testing and training purposes.

Groundbreaking subsea compression project

In 2011 ABB delivered a fourth 800xA Simulator to Ormen Lange for the site's groundbreaking subsea compression project. This is a full-scale pilot project to determine the feasibility of using subsea compression rather than topside compression to maintain a stable flow of gas when the natural pressure in the field begins to drop in a few years' time.

This is the largest subsea compression development and qualification project ever undertaken and is of huge interest to the oil and gas industry as a whole. The control system for the full-scale subsea compression project is being designed and tested in the 800xA Simulator. The subsea compression project is expected to be fully operational by 2015.

“There is no absolute requirement for a simulator facility. But our documented experience from the Ormen Lange project provides evidence that the use of the simulator facility has provided us with good safety routines in the process, as well as significant savings in the startup period of the facility.

We have consistently been able to identify logic errors at an early stage before the sequences were implemented in the control system. Operators who have access to the control room receive the best possible training on the simulator, as we consistently incorporate all changes in the process facility into the simulator.”



Geir Fillip Håseth,
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